Claims

1. A process for the catalytic cracking of ammonia, the process comprising:

supplying an ammonia feed gas to one or more heated catalyst containing reaction vessels disposed within an ammonia cracking reactor; and

cracking the ammonia in the ammonia feed gas in the one or more catalyst containing reaction vessels to produce a hydrogen containing stream,

wherein the ammonia feed gas is fed into the or each reaction vessel at a pressure of at least 10 bar,

wherein the or each reaction vessel is heated to a temperature of at least 500˚C, and

wherein the or each of the reaction vessels has a wall consisting of an alloy selected to be resistant to both nitriding and creep deformation at said temperature and pressure over an operating period of at least 1000 hours without failure, wherein the or each reaction vessel is in the form of a reaction tube in which catalyst is disposed and the alloy comprises nickel and/or cobalt in an amount greater than 11 wt%.

2. A process according to claim 1, wherein the ammonia feed gas is fed into the or each reaction vessel at a pressure of: at least 20 bar, 30 bar, 40 bar, or 50 bar; no more than 1000 bar, 500 bar, 100 bar, or 75 bar; or within a range defined by any combination of the aforementioned lower and upper limits.

3. A process according to claim 1 or 2, wherein the or each reaction vessel is heated to a temperature of: at least 550˚C, 600°C, 650°C, or 700°C; no more than 1500°C,1000°C, 950°C, 900°C, or 850˚C; or within a range defined by any combination of the aforementioned lower and upper limits.

4. A process according to any preceding claim, wherein the alloy comprises nickel and/or cobalt in an amount greater than 15 wt%, 20 wt%, 30 wt%, 50 wt%, or 75 wt%.

5. A process according to claim 4, wherein the alloy comprises a total nickel + cobalt content > 40 wt%.

6. A process according to any preceding claim, wherein the alloy comprises one or more of Cr, Si or Al.

7. A process according to any preceding claim, wherein the alloy comprises at least 10 wt%, 14 wt%, 15 wt%, 20%, or 30% chromium, such as at least 40% chromium.

8. A process according to any preceding claim, wherein the alloy comprises at least 1 wt%, 3%, or 4% aluminium, optionally no more than 5 wt%.

9. A process according to any preceding claim, wherein the alloy is selected from the list consisting of alloy 600, alloy 601, alloy 602ca, alloy 617, alloy 625, alloy 690, alloy 693, alloy 699, VDM® ALLOY 699 XA, alloy 214, alloy 230, alloy 233, alloy MA47P, alloy X, alloy S, alloy 160, S+C® G 4879, G 4878 Micro, ET 45 Micro, ET 45 LC, HT E, ET 35 Co, Paralloy® OPTIM-AL, 35/45 Microalloy, 22H, Manurite® 40XO, XAl4, XTM Low C, 40X, XTM, 50W, Manauré 2, Kubota SCH42, KHR48N, KHR48NCo, KHRSA, KHR45A, UCX, Alloy 800/H/HT, Cast grades HT, HU, HW, HX, HP15Nb, HP, HPNb, HPNbS, CT15C, Kanthal® A-1, APM, AF, D, and NIKROTHAL 40, 60, 70, 80, Alloy 120, and INCOLOY® Alloy HX, 803, 890.

10. A process according to claim 9, wherein the alloy is alloy 600 or alloy 625.

11. A process according to claim 9, wherein the alloy is alloy 214, alloy MA47P, alloy 233, alloy 699, or VDM® ALLOY 699 XA.

12. A process according to any preceding claim, wherein the or each reactor vessel wall has a thickness of: at least 3 mm, 5 mm, 8 mm, or 10 mm; no more than 50 mm, 20 mm, 15 mm, or 14 mm; or within a range defined by any combination of the aforementioned lower and upper limits.

13. A process according to any preceding claim, wherein the alloy is selected to be resistant to both nitriding and creep deformation at the operating temperature and pressure over an operating period of at least at least 5000 hours, 10,000 hours, 50,000 hours, or 100,000 hours without failure.

14. A reaction vessel for use in the process according to any preceding claim, wherein the reaction vessel comprises an ammonia cracking catalyst and has a wall consisting of an alloy selected to be resistant to both nitriding and creep deformation at an operating pressure of at least 10 bar and an operating temperature of at least 500°C for an operating period of at least 1000 hours, 5000 hours, 10,000 hours, 50,000 hours, or 100,000 hours without failure, wherein the or each reaction vessel is in the form of a reaction tube in which catalyst is disposed and the alloy comprises nickel and/or cobalt in an amount greater than 11 wt%.

15. An ammonia cracking reactor comprising one or more reaction vessels according to claim 14.